

**Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, D.C.20554**

In the Matter of

Expanding the Economic and Innovation  
Opportunities of Spectrum Through Incentive  
Auctions

GN Docket No. 12-268

**Reply Comments of  
Samsung Electronics America, Inc. and  
Samsung Telecommunications America, LLC**

**I. Summary**

Samsung Electronics America, Inc. (“SEA”) and Samsung Telecommunications America, LLC (“STA”) (SEA and STA collectively “Samsung”) are pleased to provide the Federal Communication Commission (“Commission”) with additional technical input in response to the Wireless Telecommunications Bureau’s (“Bureau”) 600 MHz band plan public notice (“Public Notice”). The Public Notice requests supplemental comments regarding issues related to the development of a 600 MHz band plan to enable repurposed television broadcast spectrum efficiently to be put to use for mobile broad band services.<sup>1</sup>

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<sup>1</sup> Wireless Telecommunications Bureau Seeks to Supplement the Record on the 600 MHz Band Plan, *Public Notice*, GN Docket No. 12-268, DA 13-1157 (WTB rel. May 17, 2013) (“Public Notice”).

SEA and STA are wholly-owned subsidiaries of Samsung Electronics Co., Ltd. Headquartered in Ridgefield Park, NJ, SEA markets a broad range of award-winning, digital consumer electronics and home appliance products, including HDTVs, home theater systems, MP3 players, digital imaging products, refrigerators and washing machines. Richardson, TX-based STA has a primary role in the research, development and marketing of innovative personal and business communications products throughout North America, including handheld wireless phones, wireless communications infrastructure systems and enterprise communication systems.

Samsung supports the “Down from 51” band plan proposal that is the focus of the Bureau’s Public Notice.<sup>2</sup> The technical discussion set forth herein in support of the “Down from 51” band plan is based on Samsung’s technical review of the issues raised in the Public Notice and the comments filed in response to the Public Notice, as well as the constraints of current and near-term technology.

## **II. Discussion**

The overwhelming majority of commenters support the “Down from 51” band plan because it minimizes interference between the various systems in the band; minimizes the need for guard bands, which would be difficult to auction; and provides potential auction participants with the greatest certainty, which is a prerequisite for a successful auction. Samsung supports the views of these commenters. Further, Samsung recommends that the Commission maximize the amount of spectrum that is available on a nationwide basis because such spectrum will provide the largest market for the development of new mobile devices, which promotes economies of scale. If more than 84 MHz of spectrum is made available, Samsung recommends

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<sup>2</sup> Public Notice at 1-2.

that the Commission provide bands below 608 MHz on either a supplementary downlink or on a TDD basis and that the bands above 614 MHz be allocated for either FDD or TDD operations. In addition, in regions where spectrum becomes available that cannot be auctioned on a nationwide basis, Samsung supports allocating this additional spectrum for supplementary downlinks or on a TDD basis.

There are many technical issues that will need to be addressed by equipment manufacturers developing handsets that support the new 600 MHz band plan and these challenges will be compounded by the need for the handsets to support multiple technologies and multiple band plans. The tradeoffs that will be required to support such multiple bands and technologies are difficult to fully evaluate at this time, in part because each carrier may have unique band and technology requirements. As a result, a full understanding of the implications of a particular 600 MHz band plan proposal is dependent upon the identity of the carriers that acquire the spectrum in the upcoming auction. Samsung's reply comments focus on issues that impact the design of 600 MHz handsets generally, including the size of the duplex gap and pass band, the requirement for guard bands to ensure compatibility with television reception, and implementation of antennas to support multiple bands. When addressing these issues as part of the design of a handset, a key constraining factor is the limited size of many devices.

Duplex Gap/Pass-Band. Samsung believes that the maximum pass band of a single filter that can be supported is 25 MHz and that supporting a pass band larger than 25 MHz may require multiple filters or advances in technology. Samsung also recommends that the duplex gap be no smaller than 10 MHz.

The typical pass band of a duplexer filter can be up to 4-6% of carrier frequency considering performance. In the 600 MHz frequency band, this equates to 25 MHz (*i.e.*, about 4.2% of carrier frequency of 637 MHz). A larger pass band is possible but it may cause additional insertion loss (“IL”) and significantly reduced performance. Samsung’s simulation of a duplex filter for 700 MHz shows that the IL is increased from 1.6 dB (typical) to 2.8 dB (typical) as the pass band of a duplexer filter is increased from 25 MHz to 30 MHz. The additional ILs for a 27 MHz pass band and 30 MHz pass band over a 25 MHz duplex filter are:

Pass band	Additional IL(Typical)	Additional IL (Maximum)
27MHz	0.6dB	0.7dB
30MHz	1.2dB	1.3dB

*\*IL of 25MHz duplexer filter: typical 1.6dB, maximum 2.5dB*

If the pass band is larger than 25 MHz in the 600 MHz band, multiple duplexers may be needed. However, multiple duplexers will result in additional 1.2-1.7dB implementation loss due to the switch between each duplexer. In addition, these switches will also require additional space in the terminal. Samsung’s experience with such multiple duplexers is that the replacement of a single duplexer with a dual duplexer will require 50% more space in the device.<sup>3</sup>

Multiple duplexers are normally implemented by front-end modules with integrated duplexers (“FEMiD”) and multi-mode power amplifier (“MMPA”). However, there are no commercial products which currently support operation at 600 MHz. When these devices become available, Samsung expects that the current limitation on the number of bands supported

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<sup>3</sup> For example, the size of single duplexer is about 2.5 x 2.0 mm and that of dual duplexer is about 3.0 x 2.5 mm.

by such devices will remain constant. Currently a maximum of six bands can be supported. It is possible to add additional bands to a device without FEMiD and MMPA technology, but such an implementation uses a very large amount of space in the device. The additional space needed in a device is more than 100 mm<sup>2</sup> to implement a single power amplifier module, a single duplexer, and a single duplexer switch to support 600MHz. Accordingly, further studies are needed of the exact band configuration of the 600 MHz band to address the development possibility of FEMiD and MMPA for this band.

*Guard Bands to Protect DTV Receivers.* Samsung notes that the “Reversed Down from 51” plan and the TDD plan would create greater risk of interference to DTV receivers than a “Down from 51” FDD proposal because it is possible for mobile devices to interfere with DTV receivers when they are in close proximity. Under any band plan adopted by the Commission, Samsung recommends that additional testing be conducted between cellular and DTV operations to ensure that the guard bands and out-of-band emissions protect DTV receivers. Samsung believes that the guard band and emissions level will be subject to DTV receiver performance. Further, Samsung notes that 3GPP has studied the out-of-band emission of mobile devices in the TV broadcast band and that 3GPP adopted a requirement for out-of-band emissions of -26.2dBm/6MHz into the DTV receiver band.<sup>4</sup> Samsung believes that the studies conducted by 3GPP took into account not only the protection of DTV receivers but also the mobile RF implementation in a given guard band of 9 MHz based on the Asia Pacific 700 MHz band plan. This information is not directly applicable to the U.S. 600 MHz band, but it is indicative of the approach to protecting TV receivers from interference.

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<sup>4</sup> 3GPP TR36.820 v11.2.0 (2012-12), “LTE for 700 MHz Digital Dividend, Section 7.3: Co-existence with TV Broadcasting.”

Antenna Efficiency / Bandwidth. The design and the implementation of a device's antenna, and the associated performance with regards to efficiency and bandwidth of the antenna will directly depend on the final band plan adopted by the Commission. This is further complicated by the support of multiple bands by mobile devices. It is very difficult to put additional bands in a device due to size constraints. For example, a 600 MHz antenna will be approximately 50% larger than an antenna supporting 850 MHz because of the wavelength of the carrier frequencies. However, on the basis of Samsung's experience, if the additional 600 MHz band antenna is considered, the practical bandwidth of the antenna is expected to be less than 20 MHz (when antenna space is about 0.4cc) due to the size constraints.

### **III. Conclusion**

Samsung appreciates the opportunity to provide the Commission with its views regarding the development of the 600 MHz band plan and encourages the Commission to quickly move forward with auction of the 600 MHz band.

Respectfully submitted,

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